

Laser manipulation of H^- beam (Progress status at J-PARC)

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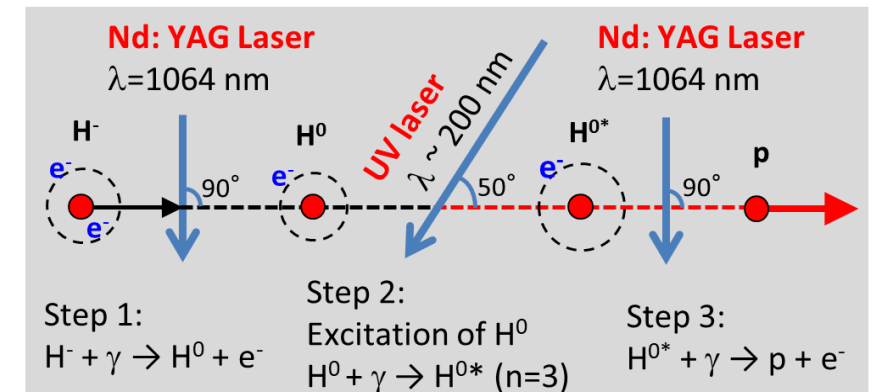
On behalf of Laser stripping team

US-Japan meeting

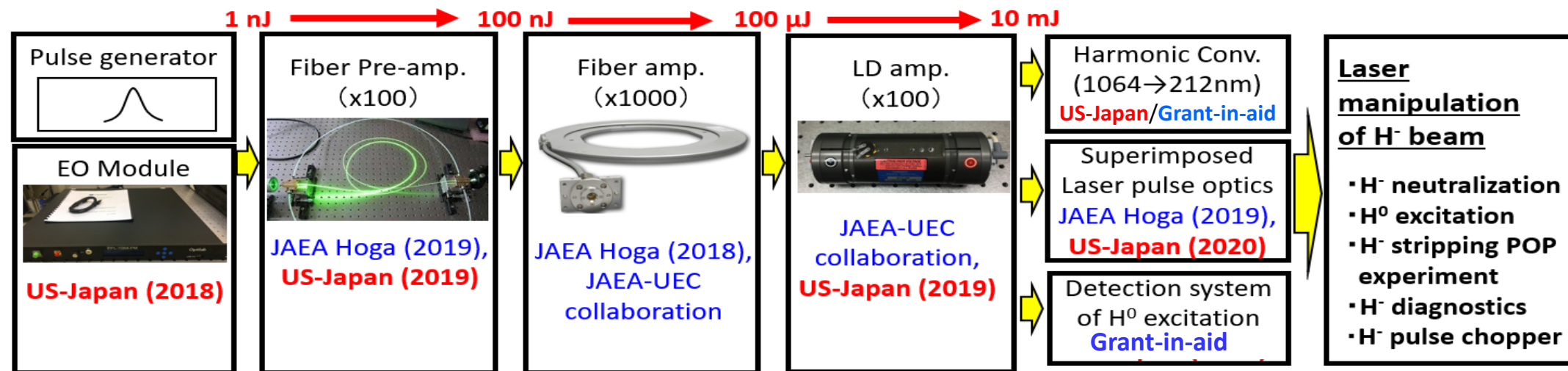
2020/10/23

Laser system for the POP demonstration of 400 MeV H^- stripping to proton

- US-Japan fund
- JAEA innovation research fund (Houga)
- JSPS Grant-in-aid (KAKENHI)



Principle of 400 MeV H^- laser stripping

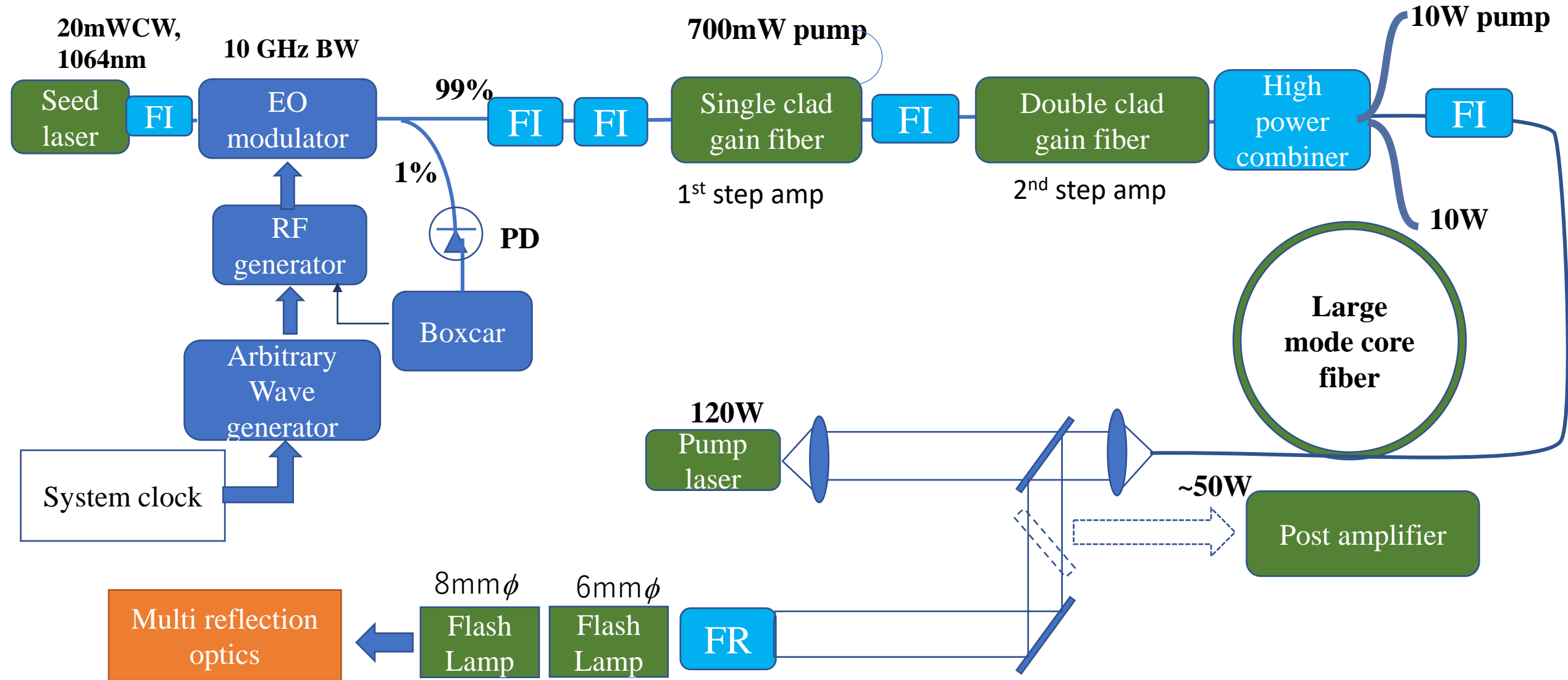


Laser system with multi-stage amplifications and applications

- ◆ A prototype YAG laser system has been developed at the UEC, Tokyo.
Specification: ~ 100 ps, 324 MHz, \sim mJ/pulse. It will be tested for 3 MeV H^- neutralization next month.
- ◆ YAG laser system for 400 MeV H^- test is under development at J-PARC.
- ◆ Crystal purchased for higher harmonic (UV) light generation. Development of the UV laser has also been started at the UEC.

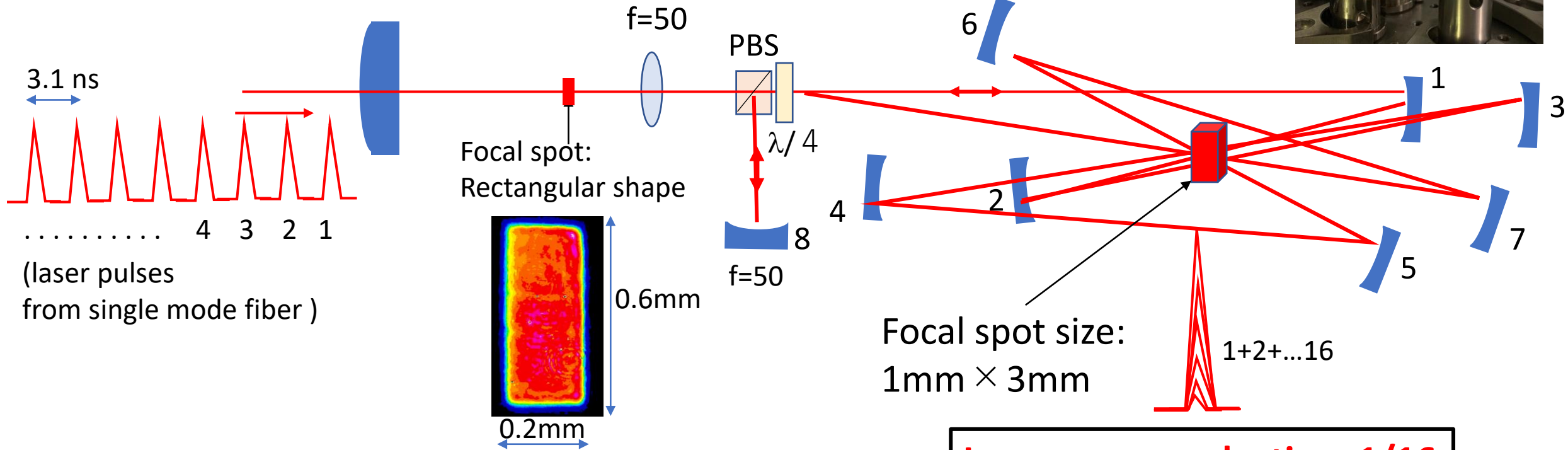
Prototype laser system developed at the UEC

Aoi Fuchi (UEC)
JPS meeting, 2020



Multi reflection laser cavity system

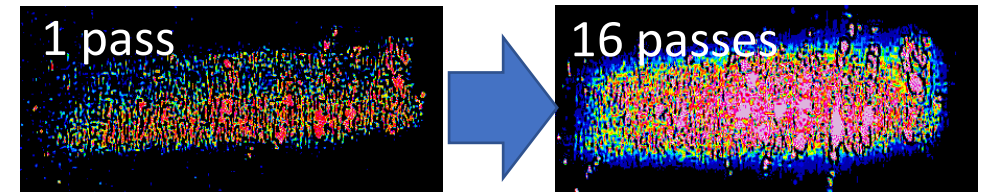
Beam shaper
(Gaussian \rightarrow Roof-top)



Multi mirror system

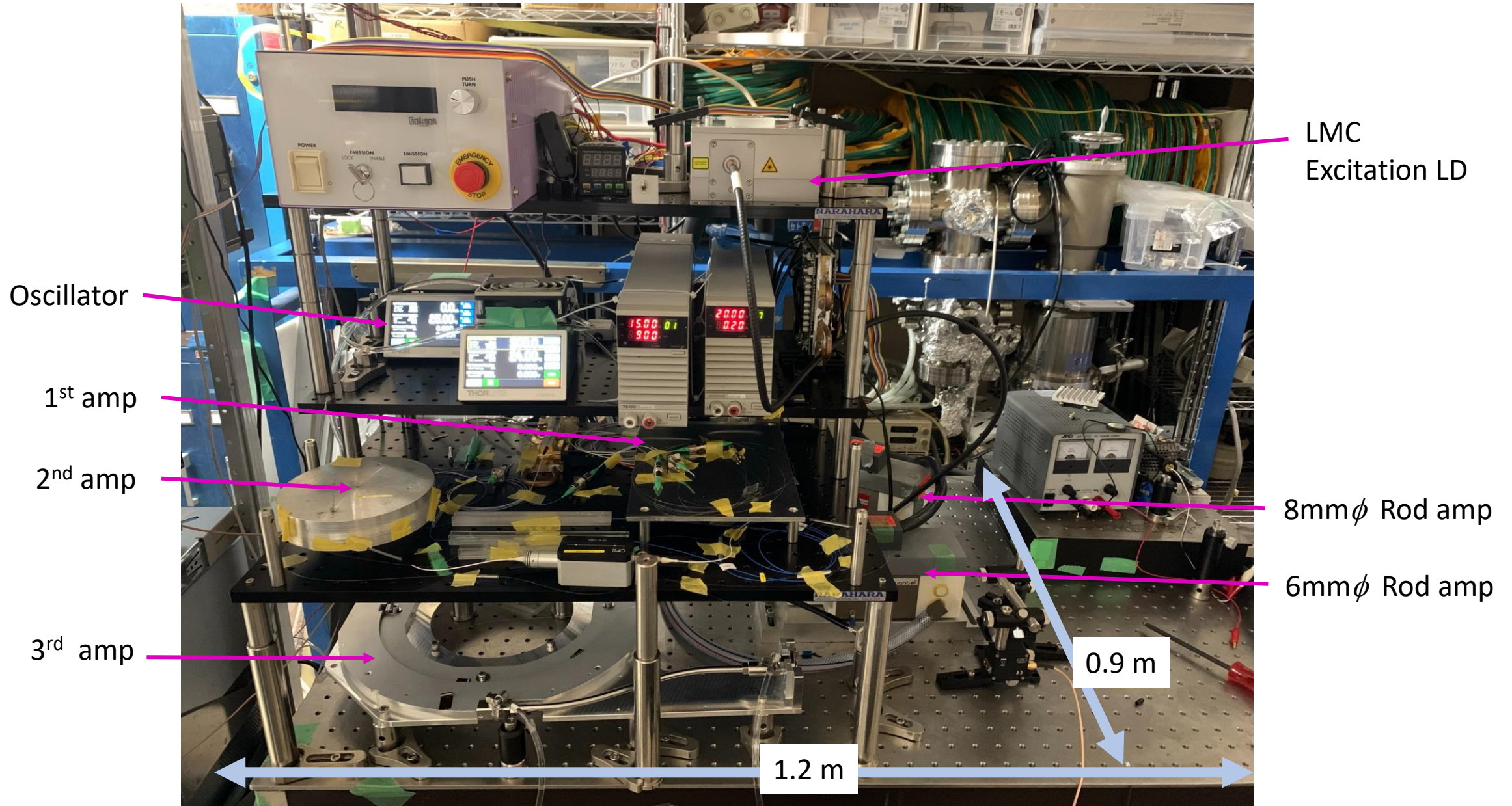


- ◆ Superimposition of 16 roof-top pulses succeeded.
 \rightarrow 1/16 reduction of the seed laser energy.
- ◆ We are also studying Fermilab type two mirror laser cavity.
- ◆ Will be tested for 3 MeV H^- manipulations starting next month.



Real system at the UEC

will be shifted to J-PARC next week.

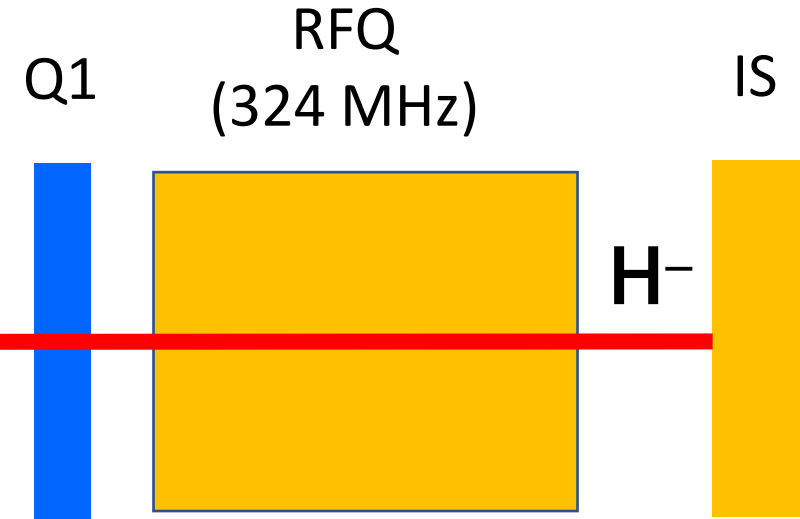
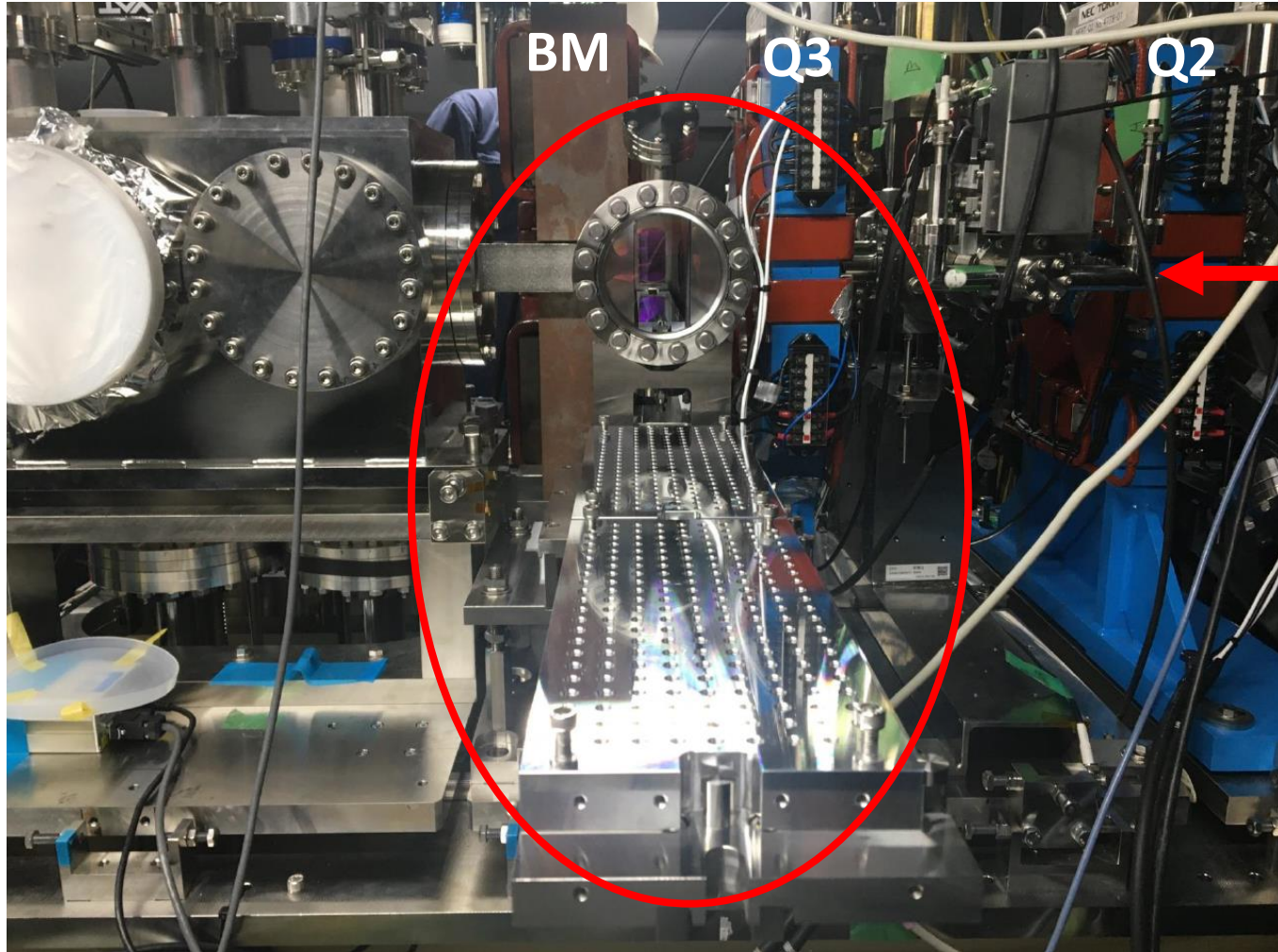


324 MHz laser pulses



Gain mismatch at the beginning already been fixed by manipulating AWG waveform and also by adjusting relative timing of the seeder and amplifier.

Laser chamber status for the 3 MeV study



- Little modifications of the chamber needed.
- Reinstallation in the beginning of Nov.
- Beam test from the mid Nov.

Schedule and status summary

	JFY 2020												JFY 2021				
To do items	4	5	6	7	8	9	10	11	12	1	2	3	4	...	10	...	3
① IR laser for ~1 mJ/pulse	R & D										Setup@RFQ-TS						
② IR laser optics, cavity systems																	
③ Chamber for 3 MeV H ⁻ test	Offline test						Install										
④ 3 MeV H ⁻ neutralization study								3-MeV H ⁻ Neut. Study		?							
⑤ IR laser for ~10 mJ/pulse																	
⑥ R&D of the UV laser	Equipment needed					R&D started (Grant-in-aid)											
⑦ R&D of H ^{0*} → γ meas. system	Equipment needed					R&D started (Grant-in-aid)											
⑧ POP study of 400 MeV H ⁻ stripping																	

◆ ① We are almost on schedule so far. The UEC team worked hard for the R&D of a prototype YAG laser.

The laser will be setup at the J-PARC RFQ-TS next week.

◆ ③ Laser chamber for 3 MeV test will be installed early next month.

H. Harada, A. Sato made it possible to maintain the original schedule.

◆ ④ The 3 MeV H⁻ neutralization study will be started in the middle of next month.

◆ ⑥ R&D of the UV laser at the UEC also been started. Crystal purchased for YAG → UV generation.

◆ ⑦ R&D of a prototype system for H^{0*} → γ measurement has also been started at J-PARC.

◆ ⑧ 400 MeV POP experiment is expected to start in autumn 2021.

Part of the US-Japan fund this year used for laser cavity items. The rest will be used for phase modulator/amp.